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(54) **Liquid cleaner containing viable microorganisms.**

(57) A cleaning composition comprises a stable suspension of abrasive particles and viable microorganisms in a water solution containing a detergent.

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LIQUID CLEANER CONTAINING VIABLE MICROORGANISMS

Abrasive cleaners have long been utilized for cleaning. These products possess a physical "cutting" activity, which is most effective in removing stubborn stains, deposits and scum, for instance from fixtures, sinks, toilet bowls and other surfaces. Such products are particularly useful in cleaning toilets, sinks and other surfaces which are then rinsed with water and discharged to sewer collection systems, holding tanks or septic systems. Almost universally, these products are highly alkaline or acidic and so in use they cause potential damage to beneficial organisms in collection lines, sewers, septic systems or holding tanks. In many applications, this hostility to microbial activity is clearly a disadvantage.

Milder detergent products, on the other hand, are also known, which cause only minimal harm to microbial activity, but are generally useful only for light-duty cleaning applications, including the removal of minor deposits of grease and dirt, but not including heavy mineral deposits, stains or particulates tightly adhering to fixtures, sinks, toilet bowls or other surfaces.

It is apparent that both of the commonly used types of cleaners, such as highly alkaline, highly acidic or milder detergent products, suffer from deficiencies, i.e., they have a detrimental effect on drains, collection systems and waste treatment systems or they have poor cleansing activity.

It is apparent that a product with strong surface cleansing properties, which also actually increases microbial activity, would provide real benefits which would include cleaner drain lines and improved waste degradation. There has been a long-standing need for a product which not only provides the benefit of strong cleaning capability, but also in use actually seeds waste collection and treatment systems, so as to improve microbial activity instead of inhibiting it.

According to an aspect of the present invention, therefore, a cleaning composition is characterised by comprising a stable suspension of abrasive particles and viable microorganisms, e.g. bacterial spores, in a water solution containing a detergent. Such a composition has the advantage of being a good surface cleaning agent and also a good deep scouring agent, along with providing the beneficial effect of bacterial action to aid in sewage treatment. Cleaning compositions according to the invention improve the microbial activity in waste collection or treatment systems.

Abrasive particles used in the compositions of the invention preferably are of hydrophobic silica. However, any number of other abrasive materials, i.e., alumina and silicas, such as clays or diatomaceous earth, can be used, so long as the pH of the resultant suspension is stabilised and is preferably selected so as to fall within the range from 5.0 to 9.0. In general, the particle size range of the abrasive is from 100 to 325 mesh (U.S. Standard Screen). The abrasive component provides deep scouring and cleaning properties. The abrasive is desirably held in suspension by a thickener. The abrasive material is generally present in a concentration of about 2 to 20 weight percent of the composition. Bentone EW, a water-dispersable clay manufactured by N. L. Chemicals, may be used as a thickener. However, other thickeners well known to the art may also be used, including many hydrophilic organic clay minerals.

The purpose of the detergent is to improve surface cleaning. Any suitable detergent or mixture of detergents, which are compatible with the other components of the composition, may be used. Typical detergents include non-ionic surfactants, such as the Triton series marketed by Rohm & Haas, the Igepal series by GAF, and Poly-Tergent B300 and B500 by Union Carbide, all of which are nonylphenoxy polyethoxyethanol compounds. The detergent is desirably present in a concentration in the range from 1 to 20 weight percent of the composition.

Any viable microorganisms or mixtures thereof, which are capable of surviving in the intended environment and have the ability to degrade or promote the degradation of municipal type waste, may be used in the compositions of the present invention. Suitable types of organisms include strains of Bacillus, Pseudomonas, Arthrobacter, Enterobacter, Citrobacter and Corynebacter. The Bacillus genus is preferred, because it not only has excellent waste-degrading abilities, but also produces a protected spore form. A preferred bacterial component includes two strains of Bacillus subtilis specifically adapted for high production of extracellular enzymes, particularly proteases, amylases and cellulases. Such strains are common in waste treatment products.

It should be understood that bacteria of suitable microbial strains, generally Bacillus subtilis, may be specifically developed for the degradation of sanitary waste. The benefits of their use include grease removal from drains and collection systems, as well as improved degradation in treatment systems, including but not limited to septic systems.

The compositions of the present invention should desirably be maintained at a relatively neutral pH, in order to ensure the establishment of proper conditions for bacteria to germinate and actively to degrade organic matter. A neutral pH also is beneficial in that it minimizes skin irritation. The preferred pH range of such products is from 6.0 to 8.0. However, a range from 5.0 to 9.0 is acceptable. The product itself may have a wider pH range, if the bacteria are in spore form.

A suitable concentration level of viable microorganisms is about 1.0×10^7/ml. However, much lower concentrations can be effective in improving waste treatment, depending on the type of system into which the compositions are introduced and the amount of material used in cleaning. An operable and preferred concentration range for the microorganisms is from 1×10^6/ml. to 1×10^9/ml. A particularly preferred concentration is $\geq 5 \times 10^6$/ml.

The following publications disclose a variety of microorganisms which may be suitable for use in cleaning compositions according to the present invention.

Technical Bulletin and Lab Report Liquid Live Microorganisms from Stero Products, P O Box 7269, San Antonio, TX 78285

Bryan, A.C. "How Enzymes Improve Sludge Digestion." Public Works, 1969 (1962). p. 83.

Robinson, R. R., "Enzymes Give Good Results in Sewage Treatment Plant." Public Works , (1954). pp. 85, 116.

Corder, W.A., "Controlling a Grease Problem." Water Sew. Works, (1955), pp. 102,42.

Chambers, J.V., "Improving Waste Removal Performance Reliability of a Waste Treatment System through Bioaugmentation. Proc. 36th Ind. Waste Conf., Perdue University, West Lafayette, Inc. (1981).

Young, J.C., and Clark, J.W., "Second Order Equation for BOD." J. Sanit. Eng. Div., Proc. Am. Soc. Civ. Eng., (1965), pp. 91, SA1, 4232.

Hand, Coleen, "Bacteria Cleaning Tanks for Navy". Landmark News Service in Roanoke Times & World News, April 30, 1984, p.2.

Haner, Steve, "Va. Firm's Mutant 'Bugs' Could be and Answer to Toxic Wastes," Associated Press, in Washington Business, November 29, 1982, p. 44.

Hyde, C.S. 1981. "The Growing Business of Bacterial Cultures." BioCycle. 6: p.25-27.

"Superbugs Soothe Sewage System." Engineering News Review. ENR: 1981 6: p. 28-29.

Tamborini, S.M., Richardson, D.S., and Horsfall, F.L. "A New Treatment for Biodegradable Waste." 40th Annual Meeting, International Water Conference, Oct. 30-Nov. 1. Pittsburgh, Pennsylvania. 1979.

Garner, C., "Bacterial Supplementation Aids Wastewater Treatment." Public Works. 111 (3): 1980. p. 71-72.

Mazer, Baig and Grenning, "Use of Bacteria to Reduce Clogging of Sewer Lines by Grease in Municipal Sewage," Biological Control of Water Pollution. ed. Tourbier and Piersow (University of Penna. Press, 1976), Chapter 28 "Bacteria Solve Problems Created by Prisoners, Public Works, June, 1982.

Bower, G.C., "Bacteria: Their Role in the Sewage Treatment Process," Proceedings of Chesapeake Water Poll. Cont. Assn., 1972.

"Clean That Sewer System With Bugs," Environmental Science & Technology, October 1979.

Gardner, C., "Bacterial Supplementation Aids Wastewater Treatment," Public Works Magazine, March, 1980.

Gasner, L.L., "Microorganisms for Waste Treatment," in Microbial Technology, 2nd Ed., Vol. II, Ed. by Peppler, H.J. and Pearlman, D. Academic Press, Inc. 1978. Chapter 10.

"Grease-Eaters Clear Sewers," Engineering News-Record, September 9, 1982, p. 12.

Grubbs, R.B., "Biotechnology is Taking its Place Wastewater Treatment," Presented at Innovative and Alternative "Emerging" Technology Seminars . Sponsored by U.S. Environmental Protection Agency and Water and Wastewater Equipment Manufacturers, 1981.

Grubbs, R.B. "Bioaugmentation, What It Can and Cannot do," 9th Engineering Foundation Conference on Environmental Engineering in the Food Processing Industry, 1979.

Grubbs, R.B., "Reducing Energy Needs Through Biotechnology," 5th Annual Convention of the Hawaii Water-Pollution Control Association, 1983.

Grubbs, R.B., "Value of Bioaugmentation for Operations and Maintenance of Wastewater Treatment Facilities," Symposium Proceedings of Wastewater Treatment Plant O & M Conference sponsored by U.S. Environmental Protection Agency, 1979.

Kirkup, R.A., and Nelson, L.R. "City Fights Grease and Odor Problems in Sewer System," Public Works Magazine, October, 1977.

A cleaning composition according to the invention thus preferably has the following composition in weight percent:

	Range	Preferred
Abrasive	2-20	2-6
Detergent	1-20	3-7
Microorganisms	1 x 10^6/ml. to 1 x 10^9/ml.	(Same)
Water	Balance	Balance

The composition desirably also contains 0.5-5 weight percent of thickener and 0.5-5 weight percent of antisettling agent.

The operating and preferred concentration ranges for the ingredients of the compositions of the present invention, in weight percent, are as follows:

	Operating Range	Preferred Range
Abrasive	2-20%	2-6%
Detergent	1-20%	3-7%
Thickener	0.5-5%	1-2%
Antisettling Agent	0.5-5%	1-2%
Microorganisms	1 x 10^6/ml-1 x 10^9/ml	$\geq 5 \times 10^6$
Water	Balance	Balance

The following Example illustrates a preferred embodiment of the present invention; the amounts are given in weight percent of the water, except for the microorganisms which are defined by their concentration by number.

EXAMPLE

The following nutrients were added to and dissolved in 1100 gallons (4,166 dm^3) of water:
yeast extract 9.6 oz (272 g)
dextrose 29 oz (822 g)
ammonium sulphate 9.6 oz (272 g)
monosodium phosphate 40 oz (1,134 g)
sodium chloride 35.2 oz (2.2 lbs = 998 g)

This water mixture was sterilized for 30 minutes at 15 pounds/in^2 pressure (103.4 kN/m^2) and 250°F (120°C). The water mixture was then cooled and inoculated with two selected strains of Bacillus subtilis. One comprised a strain selected for protease production and is designated "Series 300", available from Sybron Chemicals Inc. The other comprised a strain selected for amylase production and is designated "Series 200", available from Sybron Chemicals Inc. The bacteria were allowed to grow for 28 hours with aeration at 88°F (30°C). (The concentration of spores should be about $\geq 1 \times 10^7$/ml.)

0.5% of perfume, 5.0% of nonionic surfactant (2.75% Poly-Tergent B300 and 2.25% Poly-Tergent B500) and 100 gm of mint green dye, made by Hercules, were added to the resultant bacterial culture.

1% by weight of an antisettling agent (rheological additive MPA-1075, an olefinic polymeric complex available from N.L. Chemicals) was mixed into the water with high speed agitation for 2-4 hours to form a suspension. The antisettling agent enhances the stability of the suspension. 2% by weight of hydrophilic organic clay mineral (i.e., Bentone EW), as a thickening agent, was then mixed into the water at high speed. After a viscosity of about 1000-1500 cps developed, 5% by weight of 160 mesh hydrophobic silica was mixed into the water until a homogeneous liquid mixture was formed.

This product has been used effectively to clean toilets. In one embodiment, the product was squeezed out of a container on to a toilet brush or directly on to the side of the commode. The product was then scoured against the surface with the brush. Once the surface was clean, the product was flushed down the commode, where the organisms were taken through the system to the final place of treatment. Here they helped to degrade sanitary waste, thereby increasing the action of the treatment system. i.e., septic tank.

holding tank, etc. Once the organisms were diluted in water containing organics, they germinated and commenced the degradation of waste. They tended to adhere to the sidewalls of the entire collection system, forming a thin coating on all the pipes and the treatment vessel. This layer continued to grow and slough off new organisms into the system, thus increasing the activity and helping to keep the piping and vessels free from grease and particulates. This product has been used with success in many types of collection and treatment systems, including institutions, boats, city lines, etc. It also eliminates the need for chlorine-containing cleaners which kill activity in treatment systems. The shelf life of the product is about two years, if stored at a temperature from 33° to 110°F (0° to 43.3°C).

Claims

1. A cleaning composition, characterised by comprising a stable suspension of abrasive particles and viable microorganisms in a water solution containing a detergent.

2. A composition according to claim 1, in which the microorganisms are present in a concentration in the range from 1 x 10^6/ml. to 1 x 10^9/ml.

3. A composition according to claim 1 or 2, the pH of which is maintained in the range from 5.0 to 9.0.

4. A composition according to any preceding claim, in which the microorganisms include at least one organism selected from Bacillus, Pseudomonas, Arthrobacter, Enterobacter, Citrobacter and Corynebacter.

5. A composition according to claim 4, in which the microorganisms comprise at least one strain of Bacillus subtilis.

6. A composition according to any preceding claim, which includes a thickener.

7. A composition according to any preceding claim, which includes an antisettling agent.

8. A composition according to any preceding claim, having the following composition in weight percent:
Abrasive 2-20
Detergent 1-20
Microorganisms 1 x 10^6/ml. to 1 x 10^9/ml.
Water Balance

9. A composition according to claim 8, having the following composition in weight percent:
Abrasive 2-6
Detergent 3-7
Microorganisms 1 x 10^6/ml. to 1 x 10^9/ml.
Water Balance

10. A composition according to claim 8 or 9, which also contains 0.5-5 weight percent of thickener and 0.5-5 weight percent of antisettling agent.

European Patent Office

EUROPEAN SEARCH REPORT

Application number

EP 86 30 9599

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
	No relevant documents have been disclosed -----		C 11 D 3/386 C 11 D 3/12

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

C 11 D 3/00

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	11-06-1987	SCHULTZE D

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
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